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## (54) AUTOMOBILE VEHICLE PROVIDED WITH A CLEANING DEVICE


(71) We, THE LUCAS ELECTRICAL COMPANY LIMITED, a British Company of Well Street, Birmingham B19 2XF, England, do

hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a mechanism for cleaning vehicle surfaces such as those of the headlamps or the front windscreen or rear window.

According to the present invention there is provided an automobile vehicle, having an internal combustion engine, and a device for cleaning a surface of the vehicle, such device comprising a wiper blade adapted to be mounted for wiping movement across the surface to be cleaned and drive means for operating said wiper blade, the drive means including a flexible drive transmission, and a friction wheel mounted adjacent said engine for movement towards and away from a rotary member carried by the crankshaft, for optional contact with said rotary member.

In order that the present invention may more readily be understood the following description is given, merely by way of example, reference being made to the accompanying drawings in which:—

Figure 1 is a front elevational view showing two vehicle headlamps of the rectangular type and provided with reciprocating wiper blades moving transversely across each lamp glass.

Figure 2 is a front elevational view of the power take-off from the main driving engine of the vehicle;

Figure 3 is a side elevational, partly sectional view of the drive mechanism of Figure 2;

Figure 4 is a partly schematic plan view of the embodiment of the Figures 1 to 3;
the reciprocating drive mechanism used in

Figure 5 is a front elevational view of the mechanism of Figure 4;

Figure 6 is a view corresponding to that of Figure 5 but showing in greater detail the slave reciprocating member of the drive mechanism;

Figure 7 is a side elevational view of the "on-off" control system of the cleansing device;

Figure 8 is a view corresponding to Figure 1 but showing the reciprocating drive mechanism of Figures 4 to 6 driving wiper blades on a self-levelling lamp;

Figure 9 is a side elevational view of the self-levelling headlamp and wiper assembly of Figure 8; and

Figure 10 is a front elevational view showing an alternative form of headlamp cleaning mechanism for use with headlamps having circular lens glasses.

Referring now to the drawings, and in particular to Figure 1, there is shown the front grill compartment 1 of a conventional motor vehicle and also two headlamp units 2 and 3 respectively, of the rectangular type. The wiper blades 4 and 5 of the cleaning device are shown in the parked position, and will in fact, be concealed behind front panels of the vehicle in order to guard against unauthorised tampering with the blades and possible damage when the vehicle is being maintained or, for example, passed through an automatic washing plant.

Drive is transmitted to the blades 4 and 5 by means of a longitudinally reciprocating rod or tube 6 which extends transversely across the front of the vehicle and is actuated by a reciprocating drive mechanism 7 driven from a power source, in this case a drive take-off denoted generally by the reference numeral 8.

The mechanism also includes a reciprocating piston type of pump 9 for directing water or cleansing solution onto the headlamp glasses by way of a main conduit 10 and left and right distribution conduits 11 and 12 respectively terminating in spray units 11*a* and 12*a*.

The piston rod of the pump 9 is extended


[*Price 33p*]

to both sides of the pump and has, at one end, a connection 13 to the main reciprocating drive transmission member 6 and has its other end 14 disposed just in front of the inoperative position of an "on-off" control member 15. In line with the end 14 of the piston rod, but just beyond the position occupied by the end 14 when the blades are in the extreme position corresponding to the parked condition, is the end of a member 16 which when pivoted anti-clockwise as viewed in Figure 1, disables the power take off 8.

Figure 2 shows in greater detail the particular form of power take off for deriving a purely rotary drive from the vehicle crankshaft pulley. A drive wheel 17 is carried at one end of a swinging member 18 pivoted at 19 to a suitable support, preferably part of the vehicle body. The other end of the swinging member 18 is arranged to be contacted by a member 20 which is connected to the member 16 and moves in the anti-clockwise direction when the member 16 is itself turned in the clockwise sense as shown in Figure 1, for example, manually by the vehicle driver. The member 18 is spring biased in the anti-clockwise sense to hold the drive wheel 17 in contact with a driving surface 21 on the conventional crankshaft pulley of the engine. The friction drive surface 21, as shown in more detail in Figure 3, consists in this embodiment of a circular sectioned tube 22 brazed to the conventional retaining nut 23 holding the crankshaft pulley in place. A transverse end wall 24 of the tube 22 is threaded and receives a bolt 25 which holds down an end plate 26 to retain in position a rubber sleeve 27 mounted on the outside of the tube 22. The sleeve 27 is an extremely tight fit over the tube 22 and thus forms a friction surface against which the wheel 17 can bear for driving movement. Clearly this particular form of power take-off would need to be modified to some extent if it is to be used with a vehicle equipped with a starting handle.

Figure 4 shows the reciprocating drive mechanism and illustrates the way a purely rotary drive, transmitted from the wheel 17 by way of a flexible drive shaft 28 of Figure 3, can be converted to a purely reciprocatory drive on the member 6.

The reciprocating drive mechanism 7 comprises an elongate box structure 29 mounted parallel to the axis of member 6 and supported by the vehicle body. The flexible drive 28 feeds in at one end of the box 29 and has a pinion 30 secured thereto. The pinion 30 meshes with a pinion 31 secured to a chain sprocket 32 around which an endless chain 33 passes, the chain 33 being mounted over a further, idler sprocket 34 at the opposite end of the box 29. The sprocket 34 is freely rotatably mounted on a support member 35 mounted for sliding movement longitudinally of the box and carried by a guide 36. A bolt 37 extending parallel to the axis of the box engages threadably within an aperture at one end of the box and has, at its other end, a shoulder 38 which, upon tightening of the bolt 37, will be drawn leftwardly to tension the chain to the desired value. In practice, the chain will be adjusted for minimum backlash and noise in the reciprocating drive mechanism 7.

Figures 5 and 6 show front views of the main box of the reciprocating drive mechanism with the cover removed so as to show clearly how circulation of the chain 33 about the two sprockets 32 and 34 achieves reciprocating motion of the drive member 6.

A slave member 39 to which the reciprocating drive member 6 is secured, in this case by brazing, is mounted for sliding movement longitudinally of the box and has a slot which extends transversely over the box and is of a length greater than the spacing between the two longitudinal runs of the chain 33. This secured to and projects forwardly from a link slot 43 accommodates a drive pin 40 which is of the chain 33. In practice, the drive pin 40 may be in the form of an extended link pin of the chain 33. The drive member 6 is arranged to lie outside the plane of the chain 33 and, in this case, lies in front of the chain so that the forwardly extending drive pin 40 may engage in the slot 43 and the chain 33 is free to circulate without ever contacting the drive member 6. The drive member 6 is slidably guided in bushes 41 and 42 shown in Figure 6 as being disposed at the extremities of the elongated box 29.

During circulation of the chain 33 about the two sprockets 32 and 34, the pin 40 starts from the position shown in Figure 6, then successively moves towards one or other of the sprockets, in this case, the left hand sprocket 34 shown in Figure 5, moves around the sprocket 34 then travels longitudinally rightwardly towards the other sprocket 32 to circulate around the sprocket 32 and return leftwardly towards the Figure 6 position. Thus, during one complete cycle of movement of the pin 40, the slotted sliding slave member 39 will move to the left hand extremity of the box, then across to the right hand extremity of the box 29 and then back to the central position, during which time the wiper blades will sweep the entire surface of the headlamps once in each direction.

As a practical example, it is considered that the geometry of the various drive components should be such that when the engine is ticking over at, say 650 rpm, the pin 40 executes one complete cycle during every 11 seconds. It will be appreciated that from the arrangement illustrated in Figures 4, 5 and 6, the reciprocating drive motion generated will mean that the blades sweep across the headlamps at a substantially constant velocity

while the pin is travelling between the two sprockets 32 and 34. Only while the pin 40 is actually moving in an arcuate path around the back of each sprocket, at the ends of the path of the blades, will the blades slow down and then speed up again very rapidly. The only fluctuations in velocity to be expected when the pin is on either of the longitudinal runs of the chain will be those possibly arising from vibration of the drive wheel 17 into and out of contact with the friction drive surface 21 or any fluctuations arising from torsional elasticity of the flexible drive member 28. The on-off control and parking mechanism is illustrated more clearly in Figures 7 and 8 and includes a dash-board control handle 44, operating a push rod 45 spring-urged for movement forwardly, i.e., rightwardly in Figure 7 once a suitable locking mechanism (not shown) is released. Forward movement of the push rod 45 causes the member 15, shown also in Figure 1, to move forwardly, i.e., rightwardly in Figure 7, into the path of movement of the end 14 of the extended washer pump piston rod, so as to struck thereby and urged in the clockwise sense as viewed in Figure 1. If, at the instant when the locking mechanism is released and the push rod 45 consequently spring urged forwardly, the end 14 of the piston rod is disposed in front of the member 15 then clearly the push rod 45 will be unable to move until the piston rod end 14 has again retracted rightwardly out of the path of movement of the "on-off" control member 15, thereby allowing the desired forward movement after a short delay.

The next time the end 14 of the pump piston rod returns to the Figure 1 position it will strike the member 15 urging it in the clockwise sense into contact with a lever 16 which will be urged in the anti-clockwise direction and this anti-clockwise movement of lever 16, will as indicated above, result in anti-clockwise movement of the member 20 in Figure 2 thereby moving the free end of the member 20 upwardly to disengage the drive wheel 17 from contact with the friction drive surface 21. Figure 7 illustrates a particularly convenient layout for the linkage between the lever 16 and the member 20 as comprising a spindle 46 on which both the lever 16 and the member 20 are mounted and from which they extend radially outwardly, the spindle 46 being freely rotatably supported within a bush 47 carried by the vehicle body or the engine mounting.

From a study of Figure 1 it will be clear that the end 14 of the pump piston rod will only strike the member 15 when the blades are in their left hand or parked condition so that the drive take-off at wheel 17 and friction drive surface 21 will only be disengaged when the blades are in their parked condition. Any tendency, as a result of vibration of the engine or the vehicle body, for the wheel 17 to jump back into the contact with the friction drive surface 21 will feed back motion *via* the member 20, spindle 46 and lever 16 causing the lever 16 to undergo very slight rotational movement in the clockwise sense. However, this will trigger resumption of drive to the wheel 17 to urge the end 14 of the pump piston rod immediately further leftwardly, thereby once again disengaging the friction drive. In this way it would not be possible for the mechanism to throw itself inadvertently back into operation, provided the geometry of the member 14, 15 and 16 is arranged such that the anti-clockwise "off" movement of the member 16 is caused before the end 14 of the pump piston rod reaches its extreme left position.

Figure 1 shows that at the leftward end of travel of the wiper blades 4 and 5 they will be guided on override portions 48 and 49 so that the blade will be able to move clear of the headlamp glass and will still be maintained in the correct plane of operation so that on resumption of drive the blade will be able to recommence sweeping movement across the headlamp glass.

Alternatively, where the headlamps are of the self-levelling type and are mounted for pivotal movement about a horizontal axis the blades may be supported by the headlamp glasses themselves. For example, Figures 8 and 9 show such an arrangement as comprising a frame 60 supported by the lamp 3 which is itself pivoted at 66 for movement about a horizontal axis. The frame includes a vertical member 61 which carries the wiper blade 62 for wiping movement to and fro across the lamp during operation of the reciprocating drive rod 6.

The frame 60 further includes upper and lower horizontal channel section slides 64 which are carried by corresponding guides or rails 65 moulded into the glass of the lamp. low friction resilient linears may, if desired, be fitted between the slides 64 and guides 65.

At the extremity of its travel the blade 62 and support 61 are both concealed behind a screen 68.

The frame 60 is completed by a further vertical member 67 joining the upper and lower slides 64 and connected at its mid point to the drive rod 6. This arrangement enables the frame 60 to pivot with the lamp during self-levelling movement and to avoid imposing flexural stress on the drive rod 6 while so doing, since the rod 6 is substantially coincident with the lamp pivoting axis.

Figure 10 shows a front elevational view of an alternative embodiment of headlamp cleaning device for use with headlamps of the "circular lens" type. In this embodiment the headlamp lens glass 50 carries a spindle 51 on which is mounted a rotatable cleaning member comprising a pair of wiper arms 52

and 53 arranged for sweeping contact around the headlamp glass. The rotating cleaning member carrying the two wiper arms also carries a pinion 54 disposed forwardly of the wiper arms and engaging a rack 55 connected between, on the one hand a reciprocating drive member 6 of a unit 7 similar to that shown in Figures 4, 5 and 6 and on the other hand, a spring 56, the other end of which spring is connected to a vehicle body at 57.

Clearly, upon reciprocating movement of the member 6, the rack 25 will oscillate leftwardly and rightwardly across the headlamp glass and in so doing it will cause the pinion 54 and the wiper arms 52 and 53 to oscillate in rotational movement about the axis of the spindle 51. The relationship between the diameter of the pinion 54 and the stroke of member 6 will be chosen to provide the optimum angle of sweep per cycle of the mechanism and if, for example, the pinion 24 were to rotate through one revolution in each direction to a complete cycle of the reciprocatory drive mechanism, in that same period all parts of the headlamp glass would be wiped four times, in other words twice by each of the two blades.

The rack 55 may be replaced by a suitable alternative structure for example, a length of chain which could be held in engagement with the pinion 54 by being wound around the pinion so that tension in the chain holds the chain on the pinion.

This particular embodiment of cleaning mechanism will operate satisfactorily on all types of circular headlamp glass but it is particularly convenient if the headlamp glass can be of the concave configuration instead of the conventional convex configuration. In this way, the pinion 54 and the rack 55 can operate in a plane substantially the same as that of the rim of the lamp and the wiper arms 52 and 53 can be recessed behind the plane of the rim.

The arrangement of Figure 9 will clearly operate quite satisfactorily with self-levelling circular headlamps.

Other suitable forms of driving mechanism may be employed with the circular headlamp type of cleaning device without departing from the scope of the appended claims. For example, a continuous rotary motion may be employed by eliminating the reciprocating drive mechanism 7. However, it is preferable to employ the reciprocating type of motion since the alternative reversal of movement will assist in the sweeping action of the wiper blades and prolong the life of the blades by ensuring that the wear will be evenly spread over both sides of each wiper blade. Movement in the same direction continuously would result in "one-sided" wear of the blade.

If desired the headlamp cleaning mechanism of the present invention may be used with a control circuit of the type disclosed in our co-pending British Patent Application No. 583/72 (Serial No. 1,412,752) in which the lamp cleaning function is triggered by a driver operation such as actuation of the windscreen washer or washer/wiper or the operation of switching on the headlamps. The operating cycle of such headlamp wipers is limited by a time-responsive switch (for example a bi-metal and heating coil combination) or by a cycle counting mechanism as disclosed in the specification of our aforesaid patent application.

The reciprocating mechanism of Figures 4 to 6 may equally be used to operate a cleaning system for a glass screen in front of self-levelling and turning headlamps, or for cleaning any of the windscreens of the vehicle.

The system may include a limited slip clutch, not shown, to ensure that the blade wiping action takes place at a substantially constant rate even when the engine is running at high revs.

The headlamp wiper and drive system described above and illustrated in the accompanying drawings is also described in our co-pending Cognate British Patent Applications Nos. 54860/71 and 54642/72 (Serial No. 1,412,751) claiming the driving of the pump and the wiper blades from the circulating chain type of drive unit.

WHAT WE CLAIM IS :—

1. An automobile vehicle, having an internal combustion engine, and a device for cleaning a surface of the vehicle, such device comprising a wiper blade adapted to be mounted for wiping movement across the surface to be cleaned and drive means for operating said wiper blade, the drive means including a flexible drive transmission, and a friction wheel mounted adjacent said engine for movement towards and away from a rotary member carried by the crankshaft, for optional contact with said rotary member.

2. A vehicle according to claim 1 and including means drivably connected to said drive means for applying liquid to the surface to be cleaned.

3. A vehicle according to claim 2 wherein the wiper blade is adapted to be applied to a headlamp glass of the vehicle and the liquid applying means includes a pump adapted to apply liquid to the headlamp glass to be wiped.

4. A motor vehicle according to any one of the preceding claims, wherein said drive means comprises a flexible coaxial cable drive connected to said friction wheel and arranged to transmit rotary motion from the friction wheel towards the wiper blade drive mechanism.

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1412753 COMPLETE SPECIFICATION

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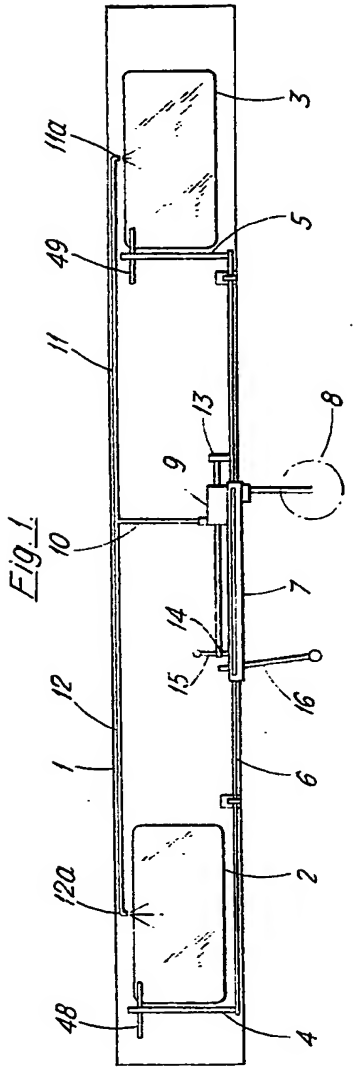


Fig.1.

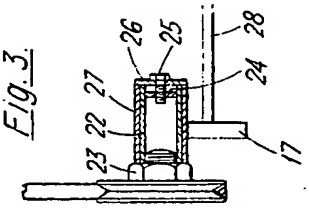


Fig.3.

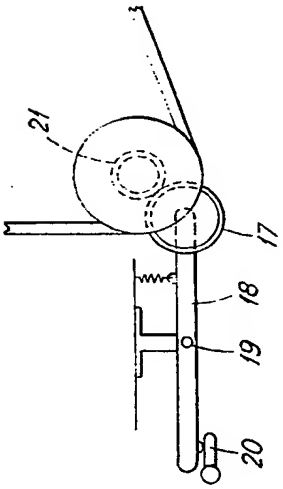


Fig.2.

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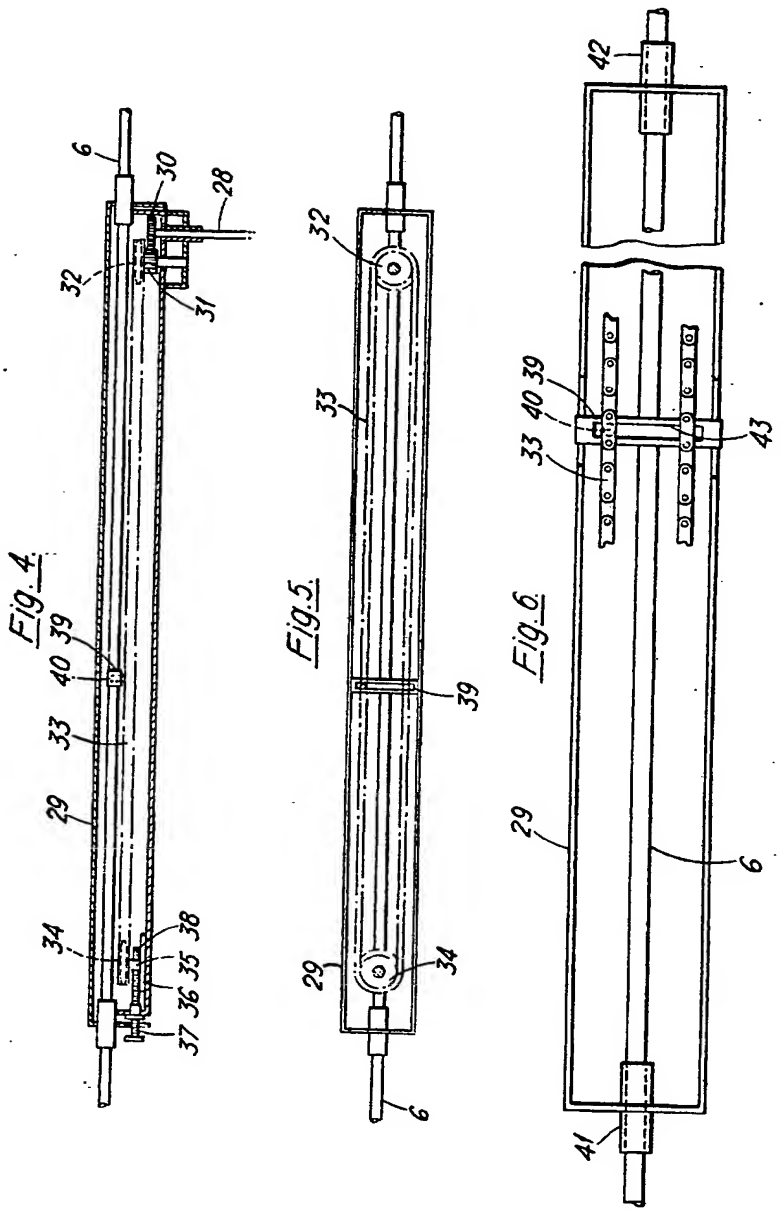

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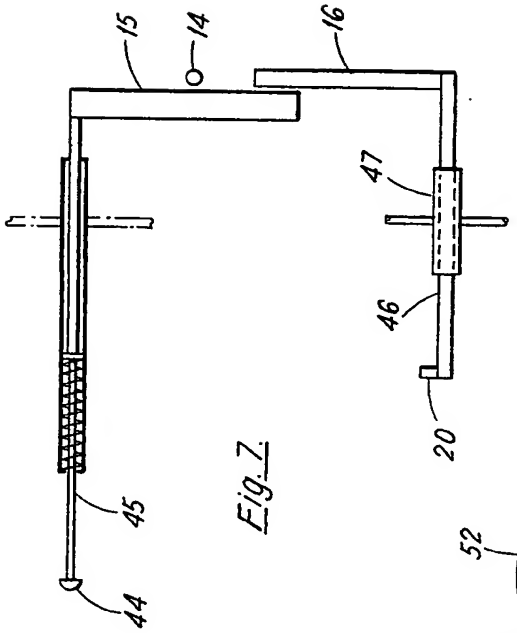


Fig. 7.

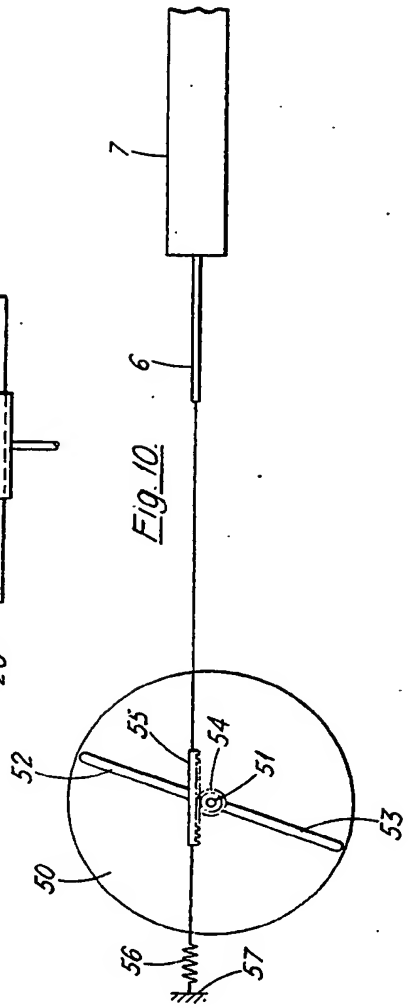


Fig. 10.

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Sheet 4

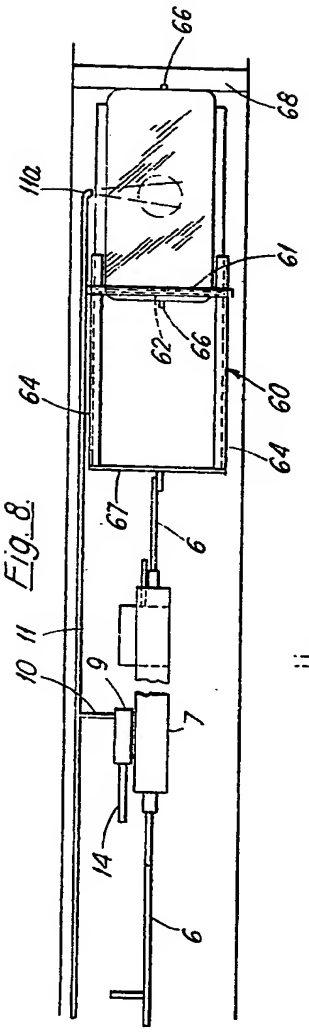


Fig. 8.

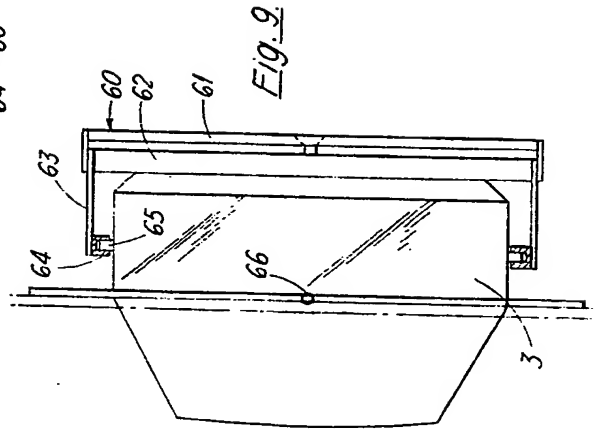


Fig. 9.